**US Army Corps
of Engineers**
Construction Engineering
Research Laboratory

DTIC FILE COPY

AD-A190 379

Initial Development of a MACOM Engineer Decision Support System (DSS)

by
Martin B. Bailey
William H. Flickinger

This report presents the results of the first phase of research on the Major Army Command (MACOM) Engineer Decision Support System (DSS) project designed to provide the MACOM Deputy Chief of Staff Engineer (DCSENG) a technical guide to office automation. The research was based on developing a generalized systems configuration and applications approach to be followed by all MACOM DSCENGs to standardize automation of microcomputer systems. The goals of this phase of research were to: (1) identify one MACOM to serve as a knowledge base from which a generalized DSS would be structured, (2) use this site to test the system configuration and software applications developed, and (3) compile the research information as a reference for the other MACOMs.

The first year's research produced two software programs, analyzed the WANG mini and micro environments, and identified a shortcoming in the MACOM automation support for the micro environment. Recommendations on training, maintenance and repair, programming support, networks, user groups, and supplies are included.

DTIC
SELECTED
JAN 1 9 1988
CA
H

ADA190 379

REPORT DOCUMENTATION PAGE	Form Approved OMB No 0704 0188 Exp Date Jun 30 1986

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS

2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	Approved for public release; distribution is unlimited.

4 PERFORMING ORGANIZATION REPORT NUMBER(S) USA-CERL IR P-88/06	5 MONITORING ORGANIZATION REPORT NUMBER(S)

6a NAME OF PERFORMING ORGANIZATION U.S. Army Construction Engr Research Laboratory	6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION

6c ADDRESS (City, State, and ZIP Code) P.O. Box 4005 Champaign, IL 61820-1305	7b ADDRESS (City, State, and ZIP Code)

8a NAME OF FUNDING/SPONSORING ORGANIZATION Office of the Chief of Engr	8b OFFICE SYMBOL (If applicable) DAEN-ZCF-M	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER

8c ADDRESS (City, State, and ZIP Code) 20 Massachusetts Ave., N.W. Washington, D.C. 20314-1000	10 SOURCE OF FUNDING NUMBERS			
	PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO
	4A162731	AT41	C	060

11 TITLE (Include Security Classification)
Initial Development of a MACOM Engineer Decision Support System (DSS) (Unclassified)

12 PERSONAL AUTHOR(S)
Bailey, Martin B.; Flickinger, William H.

13a TYPE OF REPORT Interim	13b TIME COVERED FROM _____ TO _____	14 DATE OF REPORT (Year, Month, Day) December 1987	15 PAGE COUNT 34

16 SUPPLEMENTARY NOTATION
Copies are available from the National Technical Information Service
Springfield, VA 22161

17	COSATI CODES		18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Decision Support System microcomputers
12	06		FORSCOM Deputy Chief of Staff Engineer
			office automation

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This report presents the results of the first phase of research on the Major Army Command (MACOM) Engineer Decision Support System (DSS) project designed to provide the MACOM Deputy Chief of Staff Engineer (DCSENG) a technical guide to office automation. The research was based on developing a generalized systems configuration and applications approach to be followed by all MACOM DCSENGs to standardize automation of microcomputer systems. The goals of this phase of research were to: (1) identify one MACOM to serve as a knowledge base from which a generalized DSS would be structured, (2) use this site to test the system configuration and software applications developed, and (3) compile the research information as a reference for the other MACOMs.

U.S. Army Forces Command (FORSCOM) was selected to be the study site. Micro systems, as presently configured within the various DCSENG functional offices at (Cont'd)

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL Gloria Wienke	22b TELEPHONE (Include Area Code) (217)352-6511(Ext 353)	22c OFFICE SYMBOL CECER-IMT

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

BLOCK 19 (Cont'd)

FORSCOM, were examined to determine what hardware, software, and communications equipment was used. FORSCOM DCSENG operations, their reporting requirements, and other routine demands were investigated to provide a knowledge base and reference point of automation potential applicable to all MACOMs.

The first year's research produced two software programs, analyzed the WANG mini and micro environments, and identified a shortcoming in the MACOM automation support for the micro environment. Recommendations on training, maintenance and repair, programming support, networks, user groups, and supplies are included.

DTIC
COPY
INSPECTED
6

Accession For	
NTIS GRA&I	☑
DTIC TAB	☐
Unannounced	☐
Justification	

By
Distribution/
Availability Codes
Avail and/or
Dist | Special.

A-1

FOREWORD

This investigation was performed for the Facilities Engineering Division, Office of the Chief of Engineers (OCE), under Project 4A162731AT41, "Military Facilities Engineering Technology"; Technical Area C, "Operation/Management/Repair"; Work Unit 060, "MACOM Engineer Decision Support System (DSS)." The OCE Technical Monitor was Mr. Gregory Tsukalas, DAEN-ZCF-M.

This investigation was performed by the Facility Systems (FS) Division, U.S. Army Construction Engineering Research Laboratory (USA-CERL). The USA-CERL Principal Investigator was Mr. William H. Flickinger. Mr. Martin B. Bailey is a member of the Automation Support Center (ASC), Medical Information Science Department at the University of Illinois, Urbana-Champaign. Mr. Edward Lotz is Chief of FS. The Technical Editor was Gloria J. Wienke, USA-CERL Information Management Office.

COL Norman C. Hintz is Commander and Director of USA-CERL and Dr. Louis R. Shaffer is Technical Director.

CONTENTS

INITIAL DEVELOPMENT OF A MACOM ENGINEER
DECISION SUPPORT SYSTEM (DSS)

1 INTRODUCTION

Background

The current microcomputer operating environment at Major Army Command (MACOM)* Engineering offices is as diverse as the commands themselves. A variety of equipment from name brands (like IBM) to IBM clones (such as the CORONA and WORDPLEX systems) is used. User skills range from novice to proficient, depending in part on the equipment, the hardware configuration, and the software installed. Many software applications have been taken out of the public domain. As the U.S. Army Corps of Engineers (USACE), the Department of the Army (DA), and the Department of Defense (DOD) develop and implement specialized computer systems, the MACOM Engineer and subordinate Engineering commands/installations must have the necessary equipment to handle the new applications.

To avoid acquisition of unnecessary automated data processing equipment (ADPE) and personnel retraining, USACE asked the U.S. Army Construction Engineering Research Laboratory (USA-CERL) to identify the current ADPE status and the requirements of MACOM engineer users. This information will be coupled with USACE-, DA-, and DOD-directed automation acquisition programs either in place, currently under development, or being planned for future integration, to create an interactive computer-based system to be used by managers and their staff members in support of managerial activities and decisions--a Decision Support System. The end product of the USA-CERL Decision Support System (DSS) project will be a guide for recommended systems configuration that will support current requirements and allow for future expansion of the projected applications.

Objective

The overall objective of this research is to develop integrated procedures and automated support standards for MACOM Engineers, to assist in the effective and efficient management of MACOM activities and operations.

Three goals were set for this initial phase of research: (1) identify one MACOM to serve as a knowledge base from which a generalized DSS would be structured, (2) use this site to test the system configuration and software applications developed, and (3) compile the research information as a reference for the other MACOMs.

Approach

After surveying three MACOMs (Forces Command [FORSCOM], Army Materiel Command [AMC], and Training and Doctrine Command [TRADOC]), FORSCOM's Deputy Chief of Staff, Engineer (DCSENG) organization was selected and agreed to be the study site for the MACOM DSS.

---

*A list of acronyms is provided on p 34.

A questionnaire was distributed to managers and their staff at Headquarters, FORSCOM to determine automation support needs, evaluate the current level of automation, and identify future requirements. Systems were examined to determine the present configuration of hardware, software, and communications equipment in the various FORSCOM DCSENG functional offices. A thorough understanding of the operations, reporting requirements, and other routine demands of the DCSENG at FORSCOM was needed to provide a knowledge base and reference point of automation potential for working with other MACOMs in Fiscal Year 1987 (FY87). The basic systems configuration design and software application programs could then be modified to fit the uniqueness of each MACOM.

Scope

To insure that MACOM Engineer DSS activities did not violate the spirit of official DA policy on automated developments, the MACOM DSS did not duplicate, replace, nor require changes to the hardware or software of existing or planned standard automated systems/programs (e.g., the Programming, Administration, and Execution (PAX) System). The MACOM DSS is intended to give integrated automated capabilities not provided by existing systems and within the context of Army-wide automation initiatives (e.g., STARNET and its three-tier architecture).

Mode of Technology Transfer

The management and report programs developed are in strict compliance with FORSCOM Regulation 420-3 supplementing Army Regulation 420-16.[1] The programs provide a vehicle through which the MACOMs can report information as required. Technology transfer will be through field demonstrations, packaged programs with user manuals, and USA-CERL technical reports.

---

[1] FORSCOM Regulation 420-3, *Management of Maintenance and Repair* (HQFORSCOM, 1 March 1984); Army Regulation (AR) 420-16, *Facilities Engineering Reports* (HQUSACE, 15 July 1983).

2 STUDY SITE

Site Selection

Three continental United States (CONUS)-based MACOMs (FORSCOM, AMC, and TRADOC) were surveyed by telephone to determine their present state of engineer automation and their automation needs. The survey asked for:

- job descriptions
- a point of contact for automated systems
- the kind of activities in progress
- information on assistance requested
- an indication of interest in participating in a research project to develop a standard automated approach for MACOM Engineers.

Based on the survey, FORSCOM DCSENG at Fort Gillem, GA was selected as the research site. This office had also received the least automation support to date. FORSCOM is a unique test site because it has a high demand for automated support and limited resources to support that demand. The opportunity to analyze their requirements and recommend upgrade or replacement of existing systems would be valuable in developing a general reference and technical guide on ADPE systems for future use and/or expansion.

USA-CERL personnel spoke with FORSCOM functional managers to define specific requirements and introduce the project. First, researchers anticipated that it would require several days to interview FORSCOM personnel and understand job functions. Because of this, only select individuals/offices could receive a concentrated effort. Second, recommendations may include microcomputer upgrade or additional equipment within the spirit of official DA policy on automated environments.

Physical Environment

The DCSENG is located on two installations in the Atlanta, GA area. The Military Engineering (ME) Division is at Fort McPherson. The other divisions are located at Fort Gillem. Plans are to eventually locate all of the DCSENG offices at Fort McPherson.

The various sections and divisions at Fort Gillem are located in several adjacent buildings within roughly a 5-acre area. Each building is an older two-story structure (converted World War II era temporary troop barracks) with 12 to 25 people working on each floor. The working environment is somewhat crowded and includes standard office desks and fixtures. Many of the traditional types of office equipment are available. Electric typewriters, printing calculators, photo copiers, and telephones are used regularly. Computer terminals connected to a WANG minicomputer are used in several areas. (Appendix A).

Automation Environment

The standard automation systems at FORSCOM are the WANG minicomputer systems (VS45 and VS85).

The micro or personal computer (PC) environment at both installations is an assortment of IBM and IBM clones. Each workstation is uniquely configured with installed options and enhancements, which limits transportability of programs from one workstation to another. Also, upgrades are difficult on the IBM clones. The minicomputer environment has several standard programs used by the DCSENG, however, this system as currently configured cannot handle the user demand.

Efforts are in progress (FY86) to upgrade the WANG minicomputer (VS85) system to expand memory and communications based on the projected user impact. WANG PC terminals are being added to increase the flexibility of the workstations* FORSCOM decided to stay with WANG in the microcomputer environment as well. The intent was to provide a WANG microcomputer terminal connected to the VS85 minicomputer and still provide an IBM environment (to interchange data and programs with the systems in use). The Automation Support Center (ASC) at the University of Illinois, Champaign, IL conducted a review of WANG products in light of the intended uses (Appendix B).

Automated systems used by the various divisions include VIABLE, PAX, HOMES, and the local WANG programs. Many automated systems require specific hardware capability to run standardized programs. For example, the Facilities Engineering Support Agency (FESA) delivered an INTEL 310 with WYSE PCs for Housing Management Branch to run the HOMES program.

The programs and systems are generally geared for upward reporting. Managers at the MACOM level receive information from the installations and key it into the standard automated system after reviewing and manipulating the data to meet mission requirements and budget restrictions. PCs play an important role in the evaluation process. Tne information submitted by the installations is verified and checked to ensure that it is complete, meets the objectives and guidelines of the program, and is in compliance with the regulations. This process uses programs based on established guidelines and designed by the users. After the information is analyzed, installations are contacted as required, and final packages (data) are transmitted upward via the appropriate standardized automated system.

Public domain and freeware programs were studied for application in many offices. Some enhancement programs to provide additional capability to existing software packages were also studied (Appendix C). The intent of these evaluations was to find out if programs could be compiled and adapted to local use, rather than buy new programs.

No one is presently dedicated to maintaining the PCs or providing programming support. Users must rely on their own abilities or solicit help from the Information Management Office (IMO). The Information Management Officer and staff are primarily responsible for the WANG minicomputer and its operations. To some extent, they have taken on the additional task of supporting microcomputer users. This task is not a part of their regular duties and yet they have been able to do a creditable job of keeping up with the constantly changing microcomputer technology.

---

*By the midpoint of FY87, most of the efforts had been completed.

Networks

A network is a communications link between a series of computers. It allows users to share resources and data communications.
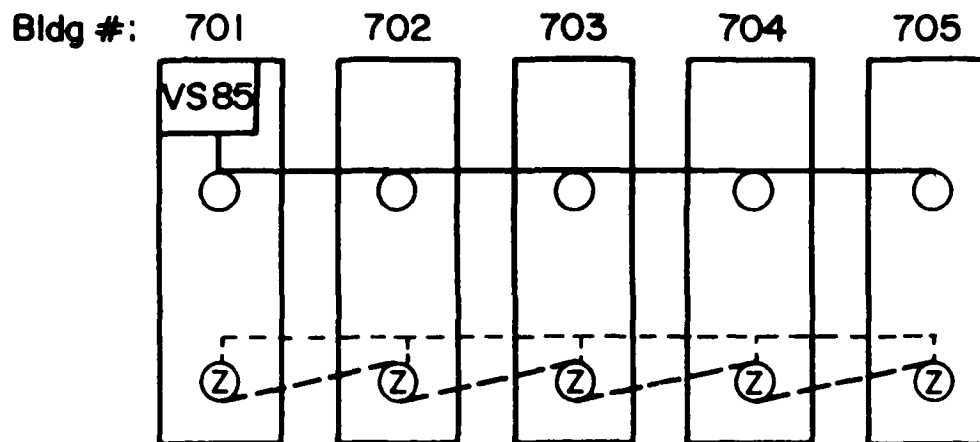
Although FORSCOM does not use a network, they do maintain two network variations. One system is a dial-up network in which users share information. The other is simply the minicomputer (WANG VS85) that links several terminals and WANG PCs (Figure 1).

FORSCOM Users

Personnel assigned to microcomputer work stations are not formally trained to work with the equipment. In some cases the user is trained on a specific application or package of programs; in others the user is self-taught or seeks assistance from IMO personnel. The personnel are highly skilled and very proficient at their jobs. Those who have sought additional instruction or taken time to understand more about their equipment have developed a large library of off-the-shelf and custom programs to assist them.

PCs are used regularly; each division possesses several. The Resources Division, for example, has 8 PCs for 30 people. In a few cases, a computer is shared in a common work area among several individuals who use it for less than 1 hour per day. Individuals with a PC on their own desk generally are the only user of that particular PC. In some instances, the work environment is too crowded to allow each worker to have a PC.

A low level of general PC knowledge exists among the users. Most users have a dedicated application for their PC and have little need or incentive to learn more about its operations. With almost no formal training, personnel use PCs only as long as they have a specific application program (usually a spreadsheet template or database) which performs a needed function. There is not much perceived benefit in learning MS-DOS, Lotus 1-2-3, Basic, or other software.

Bldg #:   701   702   703   704   705

○   WANG Terminals to VS 85 Minicomputer

Ⓩ   IBM Type PC's w/Modems

——— Direct Connect to VS 85

— — — IBM Compatible Transfer via Diskette
       or Thru Modems

Note: Symbols do not Reflect "Quantity" of ADPE,
       only Different Types. Each Building is
       Representative of a Two Story, World War II Era,
       Barracks that has been Converted to Office Space.

Figure 1. FORSCOM ADPE connections before system upgrade.

3 RESULTS AND ANALYSIS

Training

Part of the success of microcomputers in the office environment is because users get an immediate response to their work efforts. The more an individual understands ADP equipment, the software available, and how to program requirements to allow reports to flow out, the more productive that person is. However, only a handful of the FORSCOM users interviewed were participating in microcomputer education beyond their daily operations.

One of the highest priorities in an automated environment should be the basic training of the PC user. The average PC user at FORSCOM has had only a brief introduction to the PC from the IMO staff. Although this orientation produces the minimal level of skill needed to perform basic tasks, a more complete basic training course is needed.

Individuals who have the authority to form policy and make decisions about automation would benefit from higher level training in data base management, spreadsheet design, and DOS batch files.

Unless users have considerable microcomputer experience, they need formal instruction to demonstrate the value of a software package beyond its intended use.

It should be reemphasized that the Information Management staff is not responsible for PC training. They do not have the resources to take on this additional task, though they are doing it on request.

Maintenance and Repair

Because most ADP equipment at FORSCOM is relatively new, maintenance and repair (M&R) is not an issue at this time. FORSCOM has a maintenance contract for the WANG equipment, but not for the Corona, IBM, or Hewlett Packard equpiment.

Programming Support

Programming support is essential for the microcomputer to be used efficiently. Depending on the configuration of the PC, memory and disk space may be limited. Hence, it is imperative that programs and software packages being used on the equipment be tailored properly. Depending on their personal expertise, users may need help to develop a program or select a software package and set it up to do exactly what they want. User-developed programs should be reviewed for efficiency and enhancements made as required. IMO personnel have added this requirement to their long list of additional duties.

At least three sources of software programming services are available for DCSENG: (1) the third-party contractor, (2) in-house assistance, and (3) the PC users themselves. As noted earlier, there are advantages to allowing the users to experiment and try to develop applications, but without training sessions and regular guidance, there will be problems with this approach. Although users have the most knowledge of what applications are needed, they are the least qualified to actually do the programming. If

they can reach a basic level of understanding of the programming problem, they can effectively participate in planning and developing the program. Those users who are highly motivated to learn dBase or Lotus should be recognized as valuable resources for this alternate source of programming services.

The in-house approach involves a microcomputer manager and a dedicated PC programmer who works directly with the division offices. These individuals have primary responsibility for developing the requested applications. (See Appendix D for job descriptions and performance objectives.) Research and investigation is required as background to the programming task. If programmers are not dealing directly with a computer-literate PC user, they do not get requests which are sufficiently specific and complete. This problem was very apparent as USA-CERL worked with ASC to develop some programs for FORSCOM.

It is assumed that a contractor will be used only if in-house programming services do not exist (current situation). If in-house programming is developed, contractor services would be phased out. Because of the cost involved, the preferred alternative to contractors is a combination of in-house and PC user programming services. Through quality training, the PC users themselves can become effective pseudoprogrammers. They can become competent with batch files, spreadsheets, and straightforward, flat file data bases. The in-house programming staff would take over the more difficult programming tasks such as sophisticated macro-driven applications.
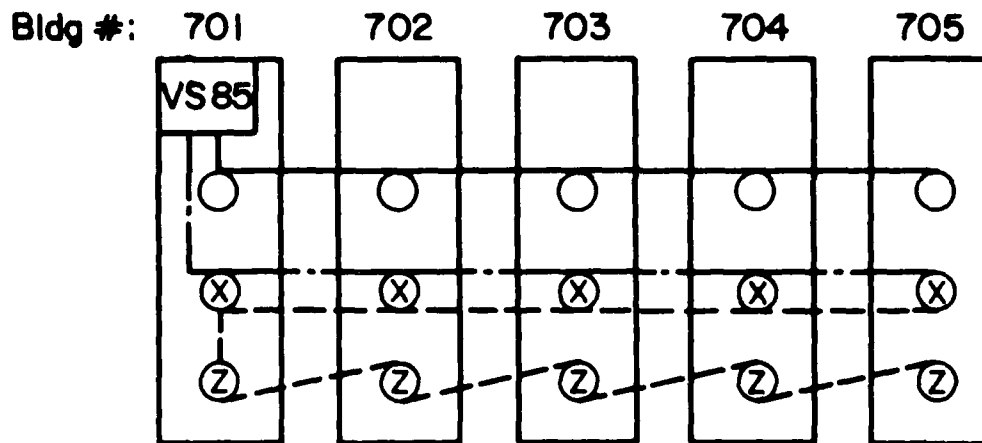
Networks

FORSCOM has two variations of a network. Figure 2 shows the ADPE connections after a system upgrade using WANG PCs.

Network installation is a major task. Besides installing the individual workstations to the network, assistance will be required to operate the network. A person must be assigned to track network use and debug program deficiencies, provide maintenance and upgrades, and provide general support, including network versions of software packages. A dedicated microcomputer manager would be essential to divisions or installations considering the purchase of a local area network (LAN).

Full consideration should be given to the eventual installation of an LAN. While it is not clear at this time that a full-featured LAN would be an effective investment (the possibility of a physical move for FORSCOM DCSENG was mentioned), it is certainly advisable to look more closely into the benefits and costs. The costs involved in setting up a network are significant but continue to decrease with advanced technology. State-of-the-art LAN systems are well advanced and beginning to show some maturity, making it unlikely that great benefits would result from delaying a purchase only for the purpose of receiving a better or less expensive product.

Full-featured networks offer the ability to create and use a clean, simple menu system. The result is a user interface that is quite easy and efficient to use, and more effective than on the typical stand-alone system. This makes users feel more confident in what they are doing. It also means that a novice can sit down and use an LAN workstation with a minimum of training. Because the DCSENG is located in several buildings at two posts, the physical layout of a network is difficult. However, the potential benefits are tremendous.

Bldg #: 701   702   703   704   705

○   WANG Terminals to VS 85 Minicomputer

Ⓩ   IBM Type PC's w/Modems

Ⓧ   WANG PC's (Emulate IBM and Serve as WANG Terminals)

──────   Direct Connect to VS 85

─ ─ ─   IBM Compatible Transfer via Diskette
or Thru Modems

─ ·─ ·─   Only WANG Compatible Information can be Transfered

Note: Symbols do not Reflect "Quantity" of ADPE,
only Different Types. Each Building is
Representative of a Two Story, World War II Era,
Barracks that has been Converted to Office Space.

Figure 2. FORSCOM ADPE connections after system upgrade.

Another advantage to the LAN environment is that there is some forced standardization of software. It is not practical to have each user's favorite word processor, spreadsheet, and database on the file server. Although some users may be disappointed, the group as a whole should benefit by selecting the best software for the network.

The greatest potential benefit of an LAN for DCSENG is in sharing data files and electronic mail. Data files are all the files created through the use of applications software, such as Lotus 1-2-3, Wordstar, WordPerfect, and dBase III. For example, when tracking M&R projects and their financing, the people in the Finance Section could retrieve the same data (or a subset of it) which is gathered by the Facilities Division at various installations. There are many other examples and interoffice situations which would profit from a shared data environment. Other shared files might include word processing documents which several offices could access or pass from one to the other (electronically) as necessary. Spreadsheet templates are often used as a budget ledger or as a simple data base containing data to be shared with others.

User Groups

A user group is an informally structured organization where computer users can share their knowledge and acquire information on hardware and software. Only a handful of the FORSCOM ADPE users interviewed indicated they were involved in a user group. These individuals were highly motivated to learn their systems and develop more applications. It was difficult for FORSCOM IMO personnel to convince staff workers that a user group can be advantageous to their performance.

Supplies

Items from diskettes to memory chips, paper to ribbons, and cables to software packages are required by the various workstations. The limited stock of standard computer supplies at FORSCOM was depleted quickly and did not keep pace with user demands. Specialty items were purchased from many suppliers. Service representatives were often not able to solve a problem because the source of the problem was an item purchased from another company. Another call, to the correct supplier, was needed.

4 MODEL PROGRAMS DEVELOPMENT

Programs currently in use were reviewed for the user's understanding of the application and to assist the Information Management personnel in determining the best software packages to use when writing specific programs. For automation to be successful, the program modules must be understandable to the user. USA-CERL subcontracted the ASC to develop programs that would help FORSCOM personnel and be transportable to other MACOMs. The model programs are: the Management of Maintenence and Repair (MMR) and the Unfinanced Requirements Report (UFR). These model programs serve as examples of using the right software package for the intended application. They also demonstrate the flexibility and potential of the microcomputer to the user by allowing active participation in the program development.

Management of Maintenance and Repair Program

The MMR program is a management tool which allows local installation engineers to become more effective and efficient. The program follows the guidelines and information found in FORSCOM Regulation 420-3 and provides a comprehensive method of tracking M&R projects from the installation level up through HQUSACE. The program is written in dBase III. It requires an IBM PC or compatible with at lease 320K of internal memory and 10 megabytes of hard disk storage. The source code and a compiled version of the program (does not require dBase III) is available.

The purpose of the MMR program is to automate the prioritizing and reporting process for installations and FORSCOM. Currently, the installations prepare the project rating worksheets using manual methods. They sort the projects by total points, rank them, and manually calculate the FORSCOM scores. The information is then forwarded for review by the DCSENG office.

By using an automated method, the reporting and comparison process is simplified considerably. Completely menu-driven, the MMR program allows input and editing of project rating worksheets, following FORSCOM Form 63-R. It then calculates the total points, the installation priority, and the FORSCOM score. It will rank projects by FORSCOM score, installation priority, current working estimate, and several other categories. The program will print a Backlog of Maintenance and Repair (BMAR), following FORSCOM Form 63-1-R. Master reports can be produced for all Operation and Maintenance, Army (OMA), Operation and Maintenance, Army Reserve (OMAR), or Army Family Housing (AFH) projects, financed or unfinanced. It will output various lists, to the monitor or printer, of projects selected by user-input criteria (e.g., Facility Category Code, Building Code, and Status of Funding).

The MMR program is for the installation Directorate of Engineering and Housing (DEH) as well as the MACOM DCSENG, Facilities Division. Within the DEH, input on project rating worksheets is provided by Resources Management, Plans and Services, and Operation and Maintenance (O&M). Easy data manipulation by the program helps Resources Management to produce their Annual Work Plan.

The flow of information in the MMR program is as follows:

1. Installation Facilities Engineer/DEH receives requests for maintenance or repair.

2. This office creates project rating worksheets with input from Resources Management, Plans and Services, and O&M.

3. They compile all worksheets into a small data base and rank the priority of each project.

4. The data base goes to Installation Command for review.

5. The Facilities Engineer/DEH ranks projects again based upon Command modifications.

6. The project rating worksheets are forwarded to the DCSENG (Facilities Division) and compiled into a single database, edited, ranked by FORSCOM score, and reviewed.

7. The edited project rating worksheets are returned to the installations.

8. The deferred maintenance and repair (DMAR) and BMAR reports are prepared by the DCSENG and sent to HQUSACE.

The MMR program was written to make it work for most installations as well as the DCSENG office. Therefore, it may not be perfect for any organization. The program is fairly easy to modify or customize.

Unfinanced Requirements Report

The UFR program follows the guidelines found in Army Regulation 420-16 to track the funding status of M&R projects for the MACOM DCSENG, Resources Division. The data used with the program is supplied by the local installation DEH Budget Office. It is probable that many DEHs could make effective use of the application. The UFR program is written in dBase III and requires an IBM PC/XT or compatible with 384K RAM and two floppy disk drives. The source code and a compiled version (does not require dBase III) are available.

The program is menu-driven and allows input and editing of M&R data. It lets the user extract information in several ways: by FORSCOM priority, installation priority, deadline date, or unfinanced amount. In addition, the user may design selection criteria to limit the output in almost any way desirable.

The flow of information in the UFR is as follows:

1. The Installation DEH Budget Office compiles the financial data and sends it to FORSCOM DCSENG (Resources Division).

2. The Resources Division compiles and maintains a data base of all installations' projects.

3. The Resources Division shares and compares data with DCSENG.

4. The UFR data base is maintained and updated as funds become available.

5. Summary reports are forwarded to USACE and The Office of the Chief, Army Reserve upon request.

6. The installation report is taken on site visits to installations for review.

5 RECOMMENDATIONS

As this is an Interim Report based solely on the requirements of FORSCOM, and not MACOMs in general, all recommendations are directed toward FORSCOM. Studies in FY87 will determine if these requirements are universal.

General

Efficient operation of a DSS requires: computer training for users, equipment M&R, programming support, networks, adequate sources for supplies, user group coordination, and program review and testing. All these items must be addressed specifically if the Army is going to maximize the potential of the ADP equipment and the users of that equipment. A decision must be made as soon as possible on how micro management will take place.

It is recommended that a dedicated Microcomputer Manager be assigned, possibly within IMO. The Microcomputer Manager would be responsible for training and maintenance of hardware and software, including filling out and tracking warranty information and service contracts, working with vendors on repairs, and training users in simple extension board installation and hardware troubleshooting.

A locally developed review or information paper could be circulated periodically to keep the user community informed of items that would have particular interest or impact to them. This would help the users keep their equipment/personal knowledge current.

Training

A short course in microcomputer operations and the use of the MS-DOS (PC-DOS) operating system would give some of the users the skills and incentive to go beyond the rudimentary level and advance to a level of true competence and confidence. Once at that level, users often begin to experiment, developing new applications and ideas for applications. By understanding what a small computer can do and what its limitations are, users will be better prepared to communicate with a programmer or network administrator about their specific needs and expectations.

Maintenance and Repair

A maintenance contract or other method of M&R is essential for all microcomputers and peripheral devices, especially in providing hardware and software upgrades and/or adding internal and external enhancements. M&R contracts could best be coordinated and administered by the Microcomputer Manager who is familiar with most software packages commonly used and is capable of working with software developers and support organizations to solve problems.

Programming Support

Programming support can be greatly enhanced through user groups and formal training on specific software packages. By developing a large pool of personnel who are proficient/familiar with specific packages, the IMO could reduce their burden for programming support and get users to do more sophisticated programming development.

The continued development of specific applications in Lotus 1-2-3, dBase III, and other similar software packages is needed.

Neworks

It is highly recommended that any significant LAN have a full-time Network Administrator. The Microcomputer Manager could train someone for this position. Since many of the qualifications and responsibilities of the two positions overlap, these two positions could be held by one individual.

User Groups

Since user groups help to disseminate information about the systems and applications, participation should be encouraged. If properly coordinated and administered, the user group can solve problems of the individual users and help teach new programs and enhancements.

Supplies

The stock of standard microcomputer supplies should be increased to eliminate the rush on supplies after delivery. The suppliers of specialty items should be selected based on their ability to provide a wider variety of the needed items and services.

APPENDIX A:

PHYSICAL LAYOUT OF MACOM DCSENG

** ADP EQUIPMENT CODE KEY **

WANG EQUIPMENT

OPERATION CENTER
1   OIS 140 Disk Drive
2   OIS 140 CPU
3   VS 85 288 MG Disk Drive
4   VS 85 CPU
5   5574 Band Printer 600 LPM
6   5573 Band Printer 300 LPM
7   6554-0 TC w/OIS & VS Boards
8   VS WS-2265-C Archiver WS
9   VS HRD/SFT Sec Archiver 2276-C
WORKSTATIONS
10   VS 4210 WS (32K)
11   VS 4205 WS 32K
12a   2256C Combined WS (64K)
12b   2256C Combined WS (32K)
13   5556C WS 64K
14   OIS 5536-3TC Teleproc Term
15a   OIS 5506-2 WS 64K
15b   OIS 5506-2 WS 48K
OIS ARCHIVERS
17a   OIS Archiver AWS-1/4/C4
17b   OIS Archiver AWS-1 TC
PRINTERS
19a   6581W Daisy Ptr 13"
19b   6581W Daisy Ptr 18"
20   DW/OS-55 Ptr
21   Ptr Dot Matrix PCPM/016
CPU
22   PC (loaned)
EXTERNAL MODEM=M
23   External Modem WA3451

OTHER EQUIPMENT

PC CPUs
30a   PC IBM CPU 5150
30b   PC IBM Color CPU 5160
31   PC Wordplex CPU
MONITORS
32   PC SAMSUNG Monitor
33   Wordplex Monitor
34   PC Princton Graphics Monitor Col
35   IBM PC Color Monitor 5153
PRINTERS
36a   Epson R-80F/T Ptr Dot Matrix
36b   Epson Ptr Dot Matrix
36c   Epson LQ-1500 Ptr Dot Matrix
37   Diablo 630 Ptr (Ltr Qual)
38   Okidata Ptr Dot Matrix
39   IBM Prtr 3287
40   Tektronix Printer
EXTERNAL HARD DISKS
41   Xebec 10 Mg Hard Disk
42   SYSGEN 20 Meg Hard Disk
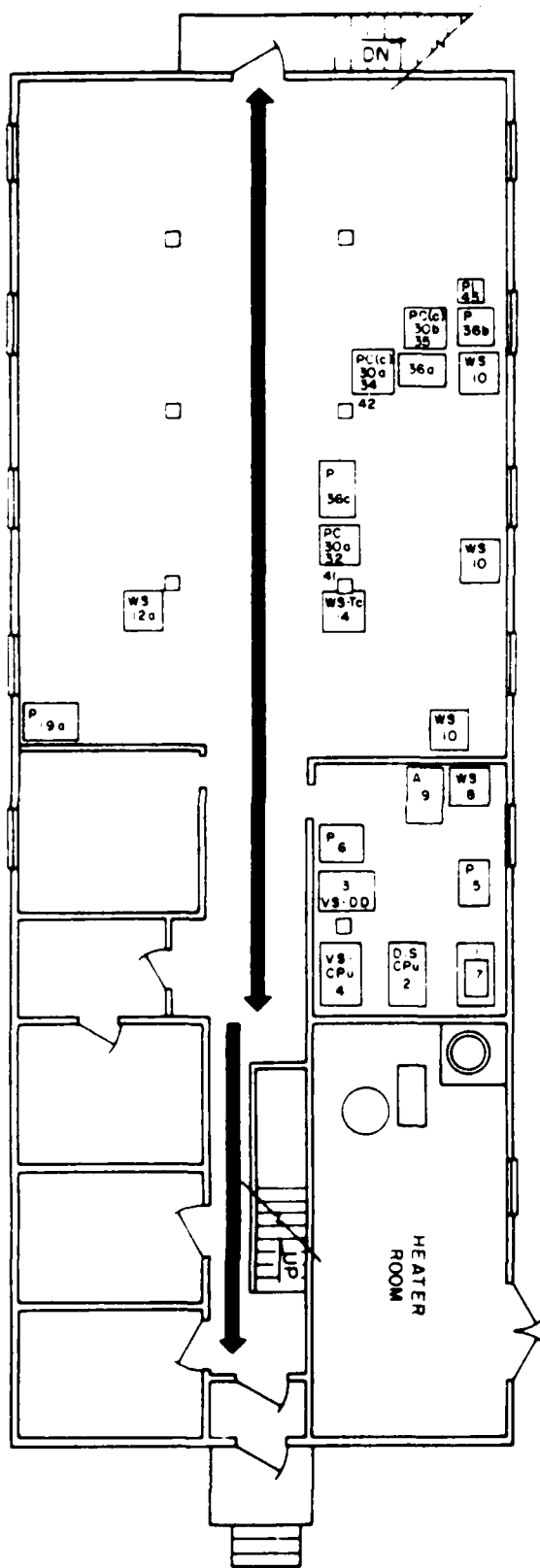PLOTTERS
43   IBM PC Plotter
44   Tektronix Plotter
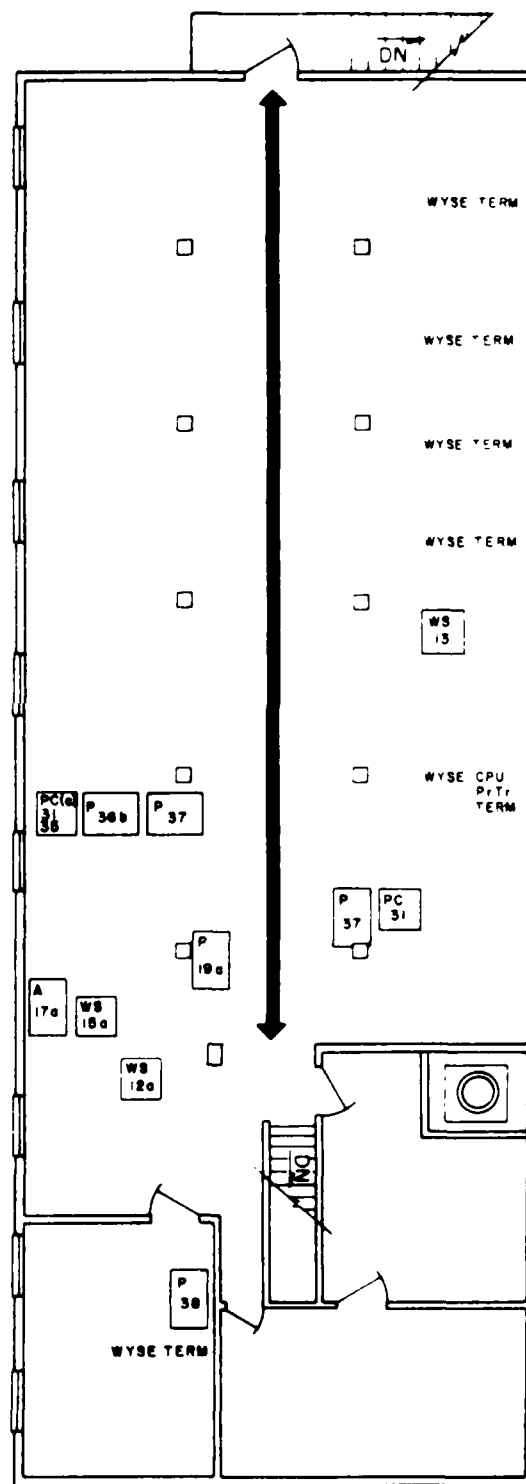45   HP Plotter
COMPUTERS
50   Tektronix Computer
51   IBM Computer 3276-12
52   Texas Inst OMNI 800 Terminal
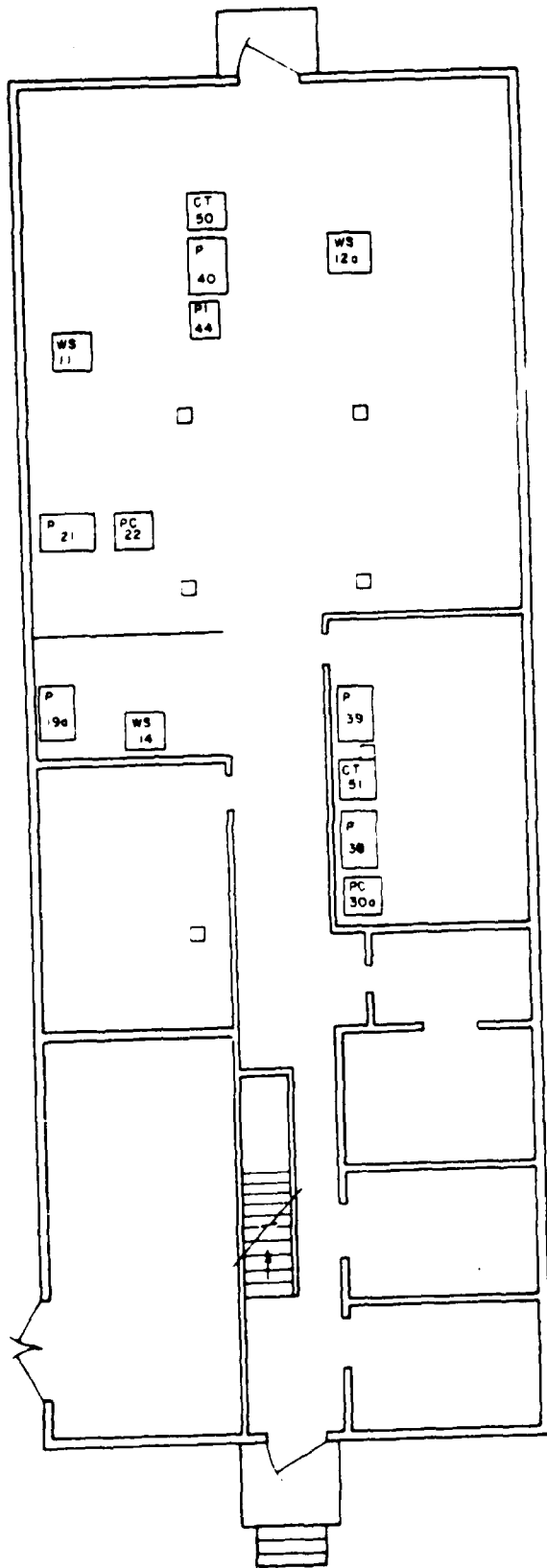53   IBM TERM 3276-2/3865-2/3276-12
DISPLAY WRITER
60   IBM Display Writer CPU/Disk Dr
61   IBM Display Wrtr Ptr
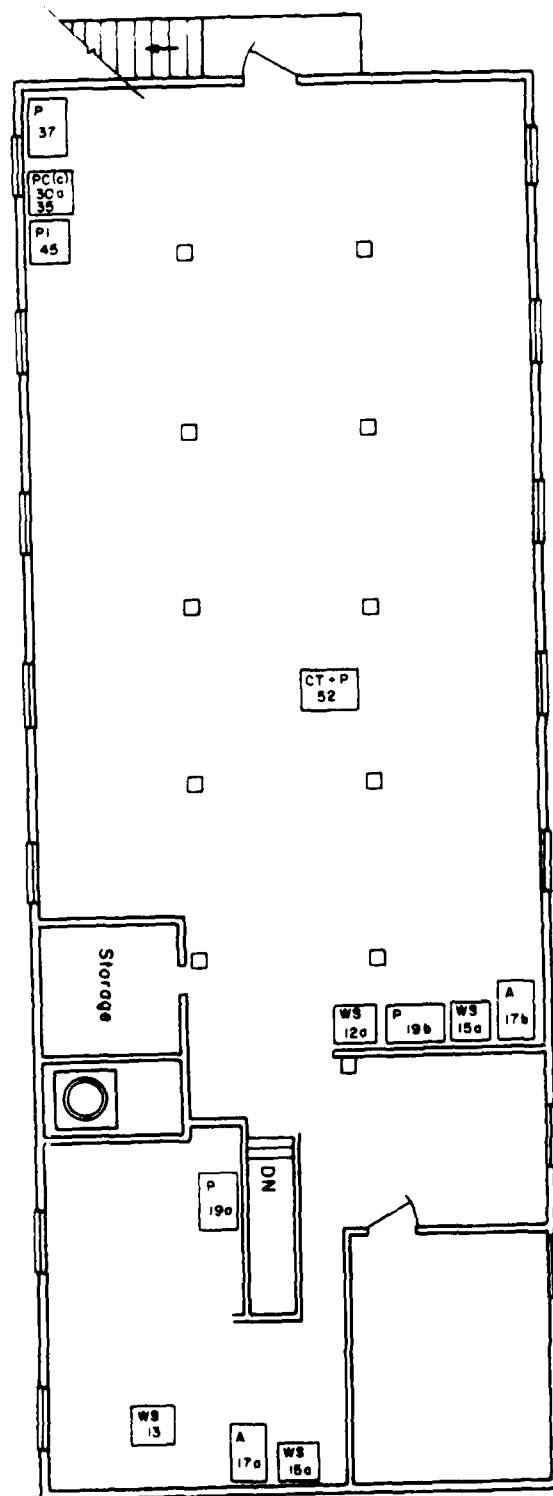62   IBM PC Expansion Unit
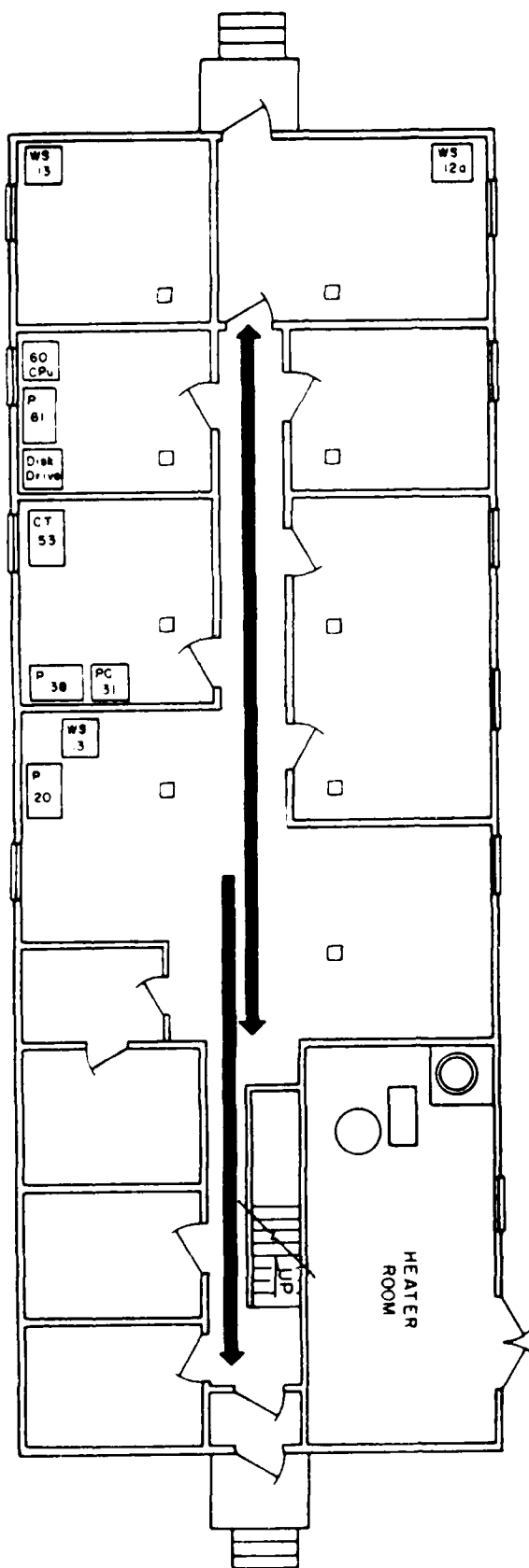
First floor, building 701.

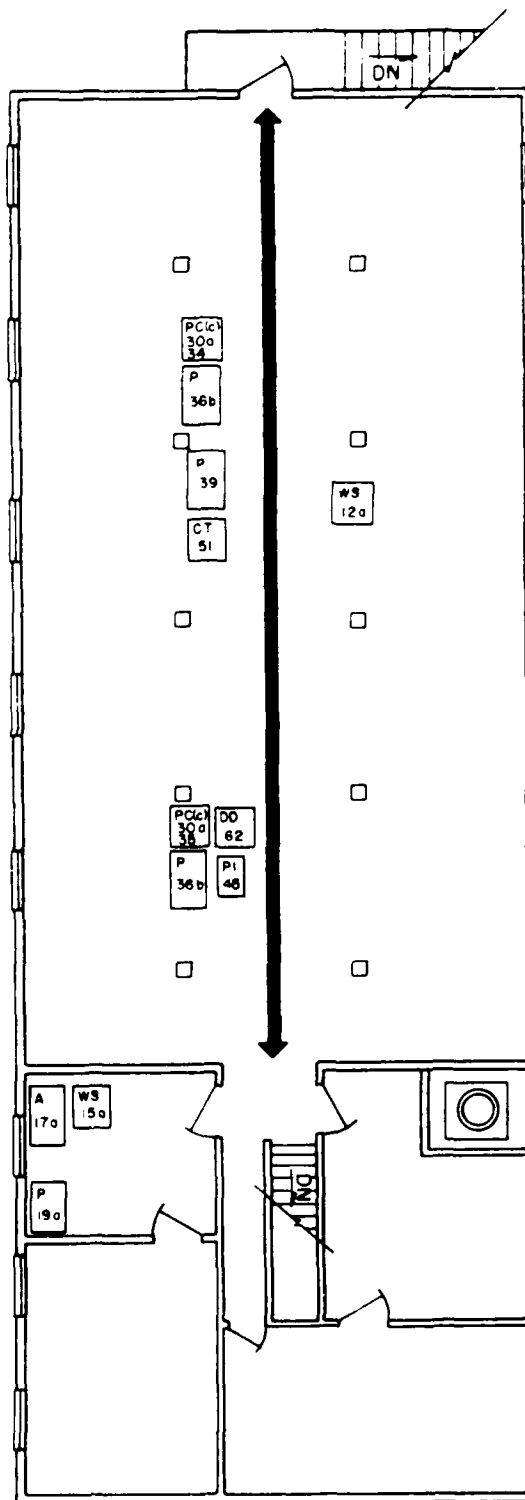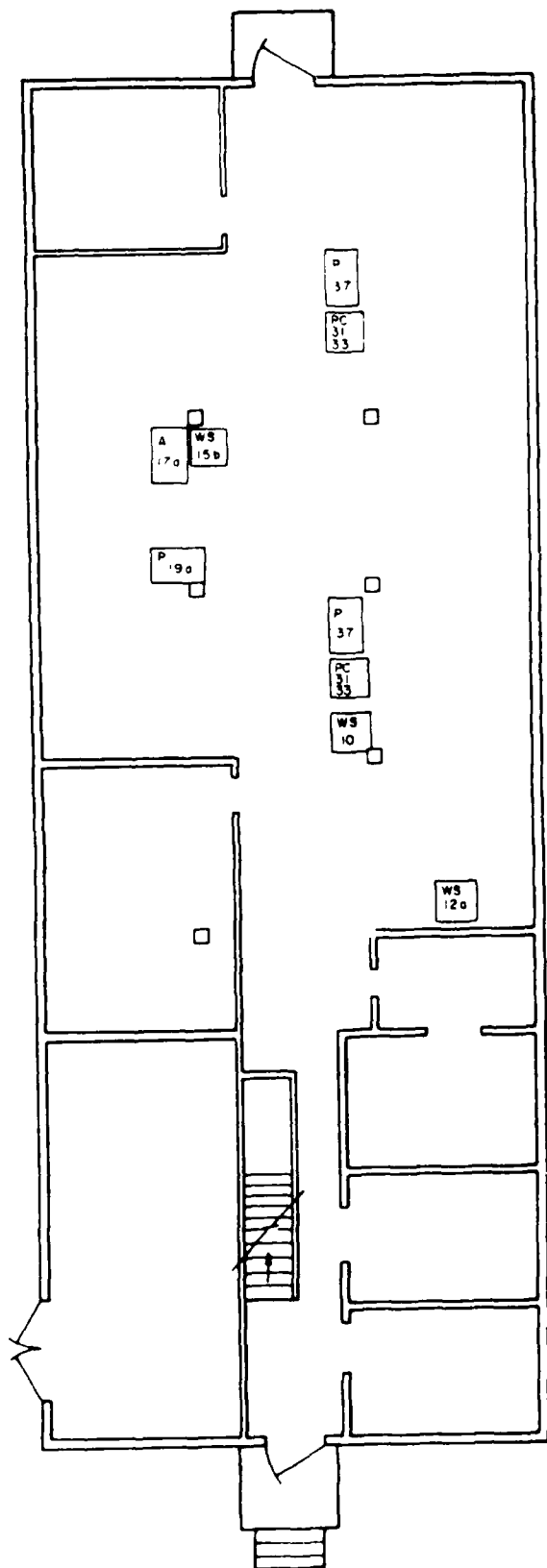Second floor, building 701.

20

First floor, building 702.
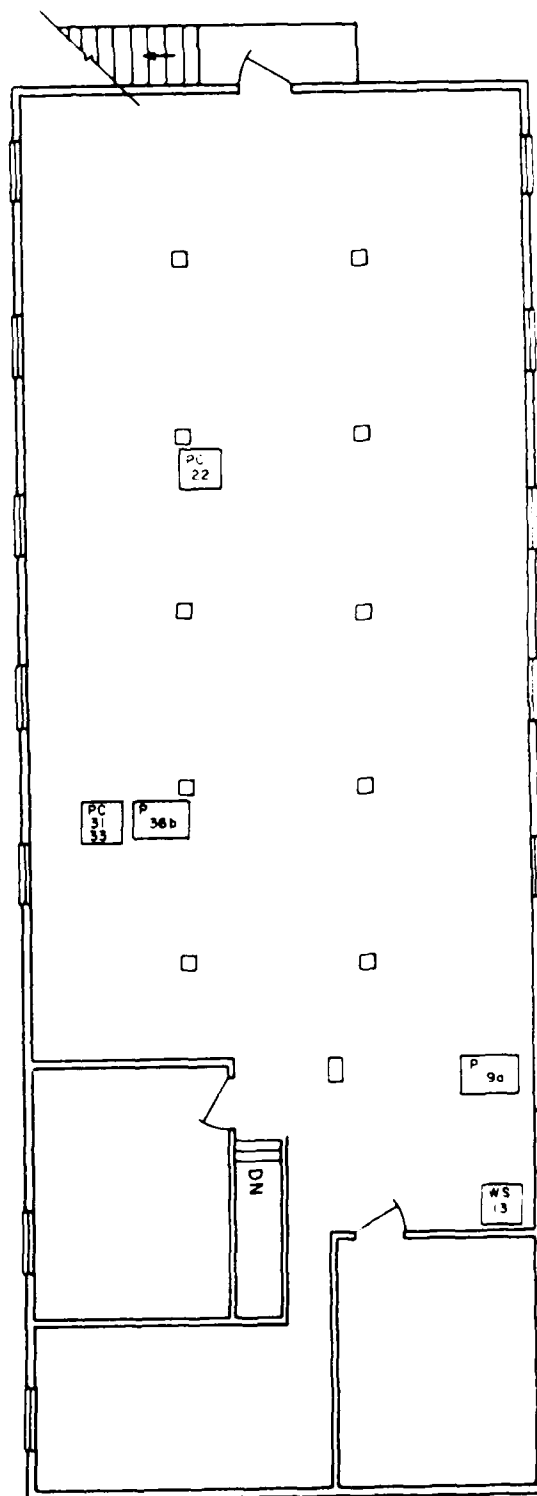
Second floor, building 702.

21

First floor, building 703.
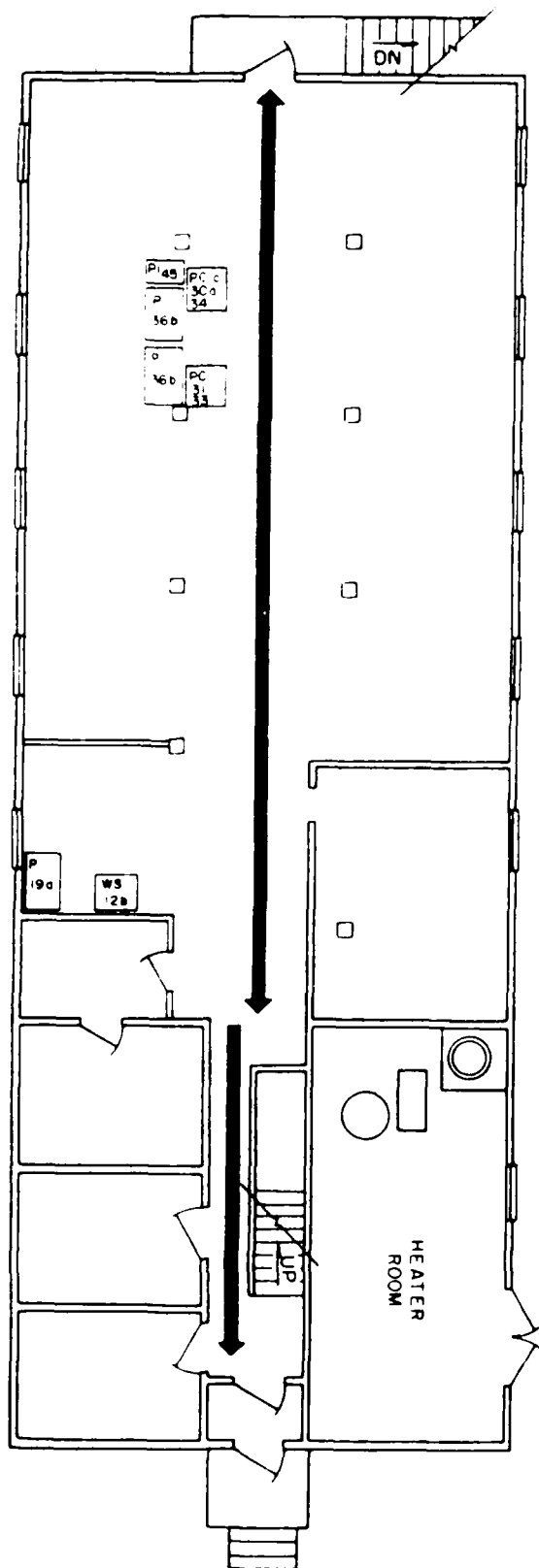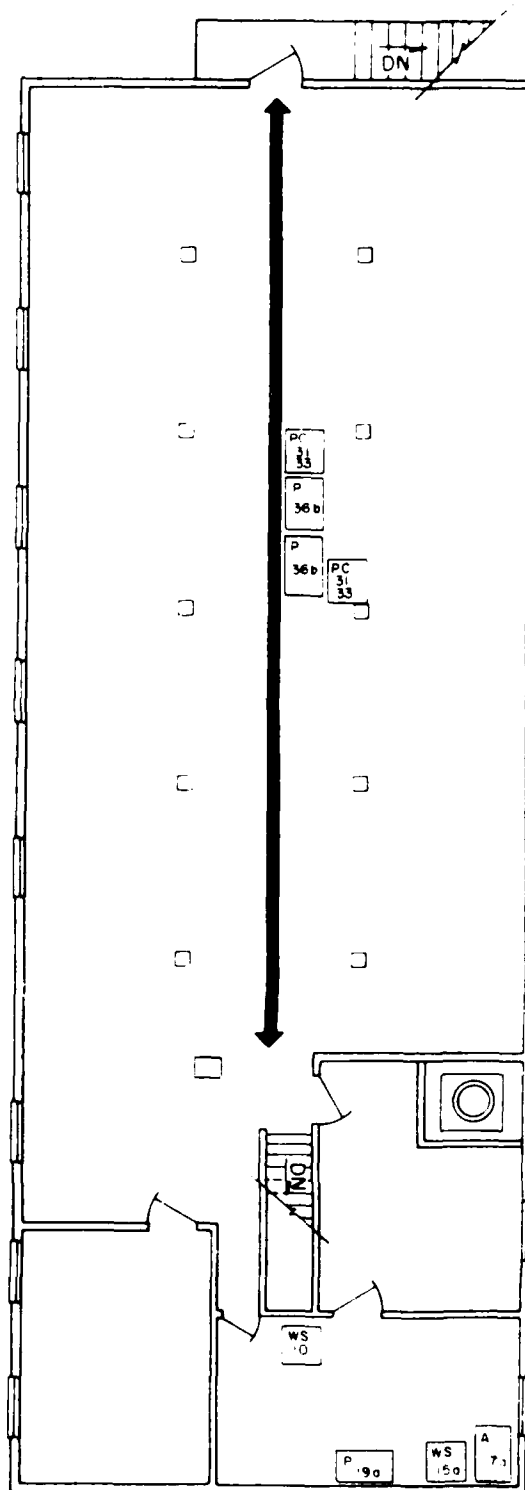

Second floor, building 703.

22

First floor, building 704.

Second floor, building 704.

23

First floor, building 705.

Second floor, building 705.

24

APPENDIX B:

WANG PC PRODUCT REVIEW

Product Description

The WANG Professional Computer is a desk top PC. It includes a 10 in. mono-chrome monitor, a full-size keyboard, and a console unit. The console unit contains disk drives, a main component board, and seven slots for additional option cards. The console with a floppy and fixed disk installed is rather large and bulky (10 in. x 15 in. x 28 in.; 31 lb). The main board contains the 8086 processor, 256K of RAM, keyboard inter-face, RS232C serial port, and a Centronics type parallel printer port.

The WANG PC uses a standard 5.25 in. floppy diskette drive and the MS-DOS operating system. However, it is not an IBM compatible by the current definition of that term. The card slots are much larger than those of the IBM PC, meaning that only those cards manufactured specifically for the WANG PC will function. The monitor is satisfactory, but is not interchangeable with any others. The keyboard is good, but is very different from IBM compatible keyboards. A full complement of manuals and reference cards are provided.

Installation/Configuration

The WANG PC evaluated includes one 1.2 megabyte floppy disk drive, one 10 megabyte hard disk drive, a WANGNet interface card, a 256K RAM card, and an IBM PC Emulation card. The IBM PC Emulation card includes a monochrome interface for the WANG monitor (nonstandard).

The installation of the three option cards was fairly easy once the proper documen-tation was located. WANG even includes the screwdrivers to do the job. The monitor connection was unique (a twin cable assembly) and required some care. The coiled keyboard cable plugged into the back of the console unit was too short for some of the physical arrangements of the components that might have otherwise been tested. Once assembled, the system is rather bulky for a typical desk top. The console unit is too large to use as a monitor stand and does not lend itself to floor mounting (the keyboard cable is too short). WANG does sell a hardware package to permanently mount the unit on the side of a sturdy desk.

The keyboard is not IBM compatible, but WANG includes a new set of about 20 keys which replace some of the standard keys. Changing the keys seems unnecessary since the new keys contain both the standard WANG function as well as the new IBM function. They also include a plastic strip with labels to define the function keys.

Ease of Use

The WANG PC is moderately easy to use. When used in the IBM emulation mode, the start-up procedure is a bit tedious. The machine will boot itself from the hard disk into WANG's own version of MS-DOS. The IBM mode can only be entered from the floppy disk drive. You must insert an IBM system diskette into the floppy drive and boot into IBM mode.

In the standard WANG mode, the machine is more friendly. There is a user interface to DOS which allows the beginner to effectively use the computer from a menu system. However, the software available for this mode (generic MS-DOS) is severely limited. The menu system works well for the novice, but more experienced users will want to bypass it.

The keyboard has a separate cursor pad, tenkey pad, and 16 special function keys. The audible keyclick is adjustable in the standard WANG mode. However, there is no way to alter it in the IBM mode. It is always on. Within the typical office environment, where word processing is the major application, this could become a problem. Through software, the keyboard is reconfigurable for several foreign languages.

Performance

The WANG PC performs well on speed tests. Under the Norton Utilities System Information (V 3.0) program the computing performance index is 1.9. This indicates an increase in speed over the IBM PC by a factor of 1.9. Experiences with dBase III on the WANG PC support that finding. The hard disk access is quick and reliable, and the processing speed is good.

The WANG was able to operate most of the popular IBM PC software in the IBM mode. It ran Lotus 1-2-3 (Release 2), Sidekick, dBase III, and dBase III Plus without problems. With less thorough testing, it appeared to run Multimate 3.3, WordPerfect 4.1, SuperCalc 2, Notebook II, PC-Talk, and Procomm. These last two are communications programs which were tested with a Hayes Smartmodem (external). There were some minor problems. Within Procomm there is a tone generated by the program which should normally terminate when the program does. For some unknown reason, the tone remains and the only cure is to turn off the computer. When using the Norton Utilities, a matrix of tiny dots (single pixels) appeared and stayed, but did not seem to affect the performance of any subsequent programs. No test of the IBM Basic interpreter was conducted. Overall, the WANG seems to have a reasonably good level of software compatibility.

WANG provides good documentation on the IBM Emulation mode, including complete instructions on using the hard disk, how it may be partitioned, and what restrictions may apply. The monitor and keyboard are also discussed. The documentation lists the restrictions to running IBM software on the WANG PC. Programs with the following characteristics cannot be expected to run:

- Programs that use the IBM Basic interpreter
- Programs that use the RS-232 Ring Indicator Signal may run but will not detect the phone ringing
- Programs that play music
- Programs that change the WANG hardware interrupt vectors
- Programs that make calls to the IBM PC BIOS.

Versatility

The WANG PC is not particularly versatile except within a WANG computing environment. As noted earlier, its IBM compatibility is limited primarily to software.

The WANG functions well with the popular printers on the market. An Epson FX286 was used throughout the test period. The Hayes external 1200 baud modem worked fine with the proper software. There is no reason to believe that most of the popular printers, plotters, and modems will not function well when connected to the WANG PC. On the other hand, do not expect to connect a keyboard or monitor to the WANG unless specifically designed for WANG. None of the many hundreds of IBM compatible option cards can be used within this computer.

WANG does offer several communication emulations and options which give the WANG PC some additional versatility. The VT100 emulation software is for asynchronous communications. WANG offers 2780/3780/WPS bisync communications and 3276 SNA/SDLC emulations for the IBM world. Within the WANG environment, this machine will double as a terminal. Three levels of network transport software are available to provide the link to a WANG VS minicomputer. WANG offers two Ethernet networks for tying many PCs together. Although the WANG PC has a great deal of versatility within the WANG computer environment, as a general purpose PC, it cannot match the IBM PC and other compatibles.

Network Features

WANG offers two different LANs for use with the WANG PC. The Local Interconnect Option is designed for small numbers of PCs. It uses standard coaxial cable and a network repeater for the first 24 workstations. Each additional group of 24 workstations needs a repeater. WANGnet uses double coaxial arrangement; one transmit line and one receive line. It is based upon Ethernet transport technology and allows up to 255 workstations. Both of these LANs are WANG creations and strictly proprietary. Significant third party support for them isn't expected. No tests on either of these LANs were conducted. The WANG PC is not compatible with any other (third party) LANs used by IBM-type computers.

Additional Comments

WANG Laboratories, Inc. appears to be ready to introduce a true IBM compatible PC. Whether the WANG PC will continue to be produced and supported is open to speculation.

APPENDIX C:

HARDWARE AND SOFTWARE REVIEWS

Corona PC ROM Upgrade

A number of older Corona PCs are in use throughout the Army. There have been various reports of incompatibilty with these units, primarily with the 3Com LAN, or with specific software packages. Another problem has been upgrading the units for use with a hard disk.

Service and technical personnel with Cordata, Inc. (the new name for Corona), indicated that a newer version of the BIOS ROM may improve compatibility. The newest version is 3.27 and is priced at $40 for a single unit. They would not make any guarantees regarding this upgrade and in fact, do not call it an upgrade. They simply say that a newer version of the ROM is available to replace older versions (i.e., 1.53 or 3.06). Cordata, Inc. personnel also said that version 3.27 would give greater hard disk compatibility when used with a Western Digital controller and that software which directly calls the ROM should be more compatible. The ROM update should increase graphics compatibility. The ROM version 3.27 should be available through any Cordata distributor or dealer.

ASC Software Review Form

DATE:	October 16, 1986
BY:	Bill Nelson
PACKAGE:	1-2-3 Report Writer
VERSION TESTED:	1.0
PRICE:	$195.00
MFG:	Lotus Development Corp.
ADDR:	55 Cambridge Parkway, Cambridge, MA 02142
PHONE:	(617) 253-9150

PACKAGE DESCRIPTION: Report Writer is a stand-alone companion product to the Lotus 1-2-3 spreadsheet. The program expands 1-2-3 database capabilities and allows development of customized reports, and mailing labels from 1-2-3 worksheet files. The program essentially is a flat file data base package.

LEARNING: Compared to other flat file data base packages, this package is not easy to learn. However, as a Lotus companion product, one can assume a reasonable level of previous 1-2-3 experience will carry over to the Report Writer. Given a working under-standing of 1-2-3, a user could be working with most of Report Writer's functions within a very short time, perhaps only 2 or 3 hours.

The program's documentation is excellent, with the exception of one critical oversight. The tutorial sections of the manual do not include any representations of the command line interface. This may seem a minor point, but the effect of this oversight is a confusing, unusable stand-alone tutorial (when not concurrently running the program). The documentation also fails to clearly orient the user in the fundamentals of Report Writer's file naming and handling features.

EASE OF USE: For the most part, the program is straightforward. Report Writer's commands are structured in a 1-2-3-style layered command menu arrayed across the top of the screen. The command line is brought to the screen by entering the forward slash key [/]. From there the command line interface is reasonably descriptive. Some of the data base commands for querying and sorting are designed in layout forms that some users may find slightly confusing.

The program has two principal work areas: the report design area, which features the file and standard data base commands, and the report layout-presentation section.

Upon entering the program, the user is prompted to select a 1-2-3 worksheet file to use in the current session. The program automatically creates a library file for each worksheet. The library file is assigned the same name as the worksheet file with [rpt] replacing the [wks] or [wk1] extension. Generated reports can be saved as a report file and reused later with updated spreadsheets. Users can assign a report file name up to 18 characters long. The report file is saved in the library file associated with the original 1-2-3 worksheet that was used as a data source for the report. A single library may contain multiple report files.

After designing a report's contents and adding any headers or footers, the user proceeds to the report presentation section by selecting the print option from the command line menu. The report layout-presentation section features its own command line menu arrayed along the top of the screen. A sample page layout fills the rest of the screen. The user can elect to proceed directly to hard copy printing or adjust a number of report layout variables (mailing label print, number of copies, page numbering, spacing, totals and statistics printing, page margins, and compressed print). The default print device is the screen, so it's a simple matter to take a quick look at the finished product before printing it.

ERROR HANDLING: Generally, the package performed as described in the documentation and no program bugs were encountered. Descriptive error messages were displayed when illegal or incorrect program operations were attempted.

The program features a restore field command that recalls the last deleted field. Setting the report print command default to the screen saves time and paper.

PERFORMANCE: The program lacks the speed of the 1-2-3 spreadsheet data base commands; some of the screen layouts are very slow. Most of the reduced performance results from Report Writer's need to call data from disk rather than directly from memory as in 1-2-3.

Report Writer performs data base calculations when the user directs the output to the printer (or screen). If a relatively large data base is used, and the user intends to review and modify the output form several times, waiting for the data base to recalculate before each on-screen review can be very tedious.

VERSATILITY: Report Writer is designed to assist 1-2-3 users with basic data base features and reports generation. Its highly structured approach is very limited relative to a full-featured data base package (dbase III+, Rbase 5000).

The program will only accept data input from a Lotus 1-2-3 spreadsheet (release 1a and 2 were tested). Data files generated by Lotus work-alike programs or SuperCalc cannot be used with Report Writer. The program also fails to provide any means of porting files out of the program and back to 1-2-3 or any other package.

29

Report Writer commands can only be accessed through the menu system. Report Writer also lacks the programming capabilities present in most full-featured data base packages.

NETWORK FEATURES: No network features. The program is copy protected; workstations must use a local disk for network operation. No site license is available.

ADDITIONAL COMMENTS: Report Writer may be an ideal solution for some environments. The program is suitable at sites with a high level of existing 1-2-3 knowledge and limited data base requirements. These sites can quickly capture the functionality of Report Writer.

SUGGESTED ALTERNATIVE PACKAGES: A full featured data base program, such as dbase III+ or Rbase 5000, may already be on site, and if the higher learning costs (relative to Report Writer) are tolerable, the long-run benefits of using a full featured data base package may exceed the easy initial use of Report Writer.

ASC Software Review Form

DATE: July 28, 1986
BY: Buz Bailey
PACKAGE: Remote
VERSION TESTED: 1.3
PRICE: $195.00
MFG: Microstuf, Inc.
ADDR: 1000 Holcomb Wood Parkway, Roswell, GA 30076
PHONE: (404) 998-3998

PACKAGE DESCRIPTION: Remote is a remote control communications program. It allows a user to call in via modem to a host computer (running Remote) and log in to that computer. Once logged in, the user may operate the host just as if he were at the console of that computer. Almost any program may be operated in remote mode. The major limitation is the speed of transmission, which is dependent upon the modems being used.

Remote's mail system offers some of the features of an electronic bulletin board. Standard file transfers are fully supported.

LEARNING: Although communications may be the most difficult major PC application to learn, Remote is not particularly difficult for someone who is experienced with PC communications programs. A novice user however, would need assistance and more explanation than the manual offers.

The manual is fairly well written, but somewhat brief; it can be read in about 30 minutes. Multi-colored tabs identify each chapter. The chapters cover the installation process, setting up the communications parameters, running the package, and using the mail system.

EASE OF USE: Remote is remarkably easy to learn and use, considering the magic it performs. The program opens to a simple screen which reads 'Waiting for call .....'. The only other option is to hit ESC to go to the main menu. Main menu options include use mail, list user log, and change or add user information. The menus are simple and easy to use.

The primary problems were not documented in the manual. The first problem relates to the fact that Microstuf, Inc. recommends Crosstalk XVI (their own product) for use as the terminal package to communicate with the host running Remote. Crosstalk uses the ESC (attention) key to drop out of terminal mode and enter local mode. Remote uses the ESC key to go into screen mode and it cannot be changed. Since some Crosstalk keys can be reassigned, the solution is fairly obvious. The Crosstalk attention key (ESC) must be reassigned to some other unused key on the keyboard.

The other problem involves the use of device drivers. Remote does not coexist with many device drivers and it is therefore necessary to eliminate the drivers from any start-up batch files. The most common one is ANSI.SYS.

ERROR HANDLING: Hard errors were not encountered when using Remote. Many situations might result in soft errors (those caused by user error). The most common soft error is in the communications parameters. Like any other communications program, if the parameters are not set up properly, the program will not work. It has no way of telling the user what is wrong. The user must locate the error.

PERFORMANCE: The package performed quite well for the most part. It is quick and efficient. The main performance problems result from running sophisticated PC programs in the full screen mode. When trying to run Lotus 1-2-3, dBase III, or WordPerfect, some compromises must be expected. At 1200 baud (or 2400) some time will be spent just updating the screen. Remote is probably best suited to accessing these programs for some particular application or data file. Because of connect cost and error checking, it makes little sense to try to create files from a remote location.

The other functions of Remote are quite good. As a message system with full logon security, or as an unattended data file transfer program, it is excellent.

VERSATILITY: Remote is very versatile within the narrow scope of what a communications program is capable of doing. Although it isn't designed for every need, as it is quite useful and versatile as a bulletin board, a file transfer program, or a remote terminal program.

NETWORK FEATURES: Remote is a stand-alone package not meant for normal LAN use. However, it does have an LAN function. As a communications program it allows remote access to an LAN. With Remote installed and running on an LAN workstation, a network user can call the workstation, log or Remote and then go to DOS and log in to the network. Remote would not ordina .y be used directly on an LAN file server, because it would require a general LAN login which would deny access to the private files of any specific individual.

ADDITIONAL COMMENTS: Microstuf, Inc. personnel were quick and knowledgeable about Remote. They provided the information about device drivers (which is not in the manual).

SUGGESTED ALTERNATIVE PACKAGES: This is a relatively new category of software and no others have been tested or even observed at this point.

APPENDIX D:

JOB DESCRIPTIONS AND PERFORMANCE OBJECTIVES

Microcomputer Manager

Description

The Microcomputer Manager is a salaried individual responsible for the selection, maintenance, and management of PCs and related resources, and the training and support of PC users and their software applications. The Manager interacts with PC users, management, and vendors of hardware and software. The Network Administrator reports to the Microcomputer Manager, who in turn reports to the Manager, Information Systems (or EDP Manager).

Qualifications

- Personal interaction skills

- Verbal communications ability

- Written communications ability

- Minor level of programming experience

- Extensive knowledge of operating systems (primarily MS-DOS)

- Wide background of experience with PC software, including word processors, spread-sheets, data bases, memory resident programs, and communications

- Significant knowledge of LANs

- Experience with PC hardware troubleshooting and repair

- Administrative experience (delegating, recordkeeping, prioritizing)

- Experience with accepted business practices (accounting, project planning)

- Ability to relate to high-level management personnel (negotiation skills)

Duties and Responsibilities

- Training users through classroom instruction and individual lessons

- Inventory of equipment and software

- Equipment maintenance, configuration, and troubleshooting

- Software maintenance, configuration, and upgrading

- Consultation and recommendations regarding selection of PCs, related equipment, and software

- Consultation and recommendations regarding human resources

- Problem tracking, solving, and follow-up

- Psuedoprogramming (batch files, spreadsheets, data bases)

- Computer product knowledge and continuing self-education

32

Local Area Network Administrator

Description

The LAN Administrator is a salaried individual reponsible for the O&M of an LAN. The Administrator interacts primarily with network users and reports to the Micro-computer Manager.

Qualifications

- Personal interaction skills
- Verbal communications ability
- Reasonable level of writing skill
- Knowledge of MS-DOS
- Experience with a variety of PC software
- Some knowledge of LANs
- Experience in troubleshooting PC hardware
- Basic administrative ability (record keeping, prioritizing)

Duties and Responsibilities

- Perform routine network procedures (add, delete, and modify users, peripherals, and services)
- Periodic backup of central files (restore when necessary)
- Inform users of new network features and resources
- Inform management of changing network and user needs
- Maintain software upgrades and install on network
- Train users through classroom instruction and individual lessons
- Operation and maintenance of all shared peripherals
- Problem tracking, solving, and follow-up
- Expansion of the network as necessary

LIST OF ACRONYMS

ADPE	automated data processing equipment
AFH	Army Family Housing
AMC	Army Material Command
ASC	Automation Support Center
BMAR	Backlog Maintenance and Repair
CONUS	Continental United States
DA	Department of the Army
DCSENG	Deputy Chief of Staff, Engineer
DEH	Director of Engineering and Housing
DMAR	Deferred Maintenance and Repair
DOD	Department of Defense
DOS	disk operating system
DSS	Decision support system
FESA	Facilities Engineering Support Agency
FS	Facility Systems
FORSCOM	Forces Command
FY	Fiscal Year
HQ	Headquarters
IMO	Information Management Office
LAN	Local Area Network
MACOM	Major Army Command
ME	Military Engineering
MPAT	Military Programs Analysis Team
MMR	Management of Maintenance and Repair
M&R	Maintenance and Repair
OCE	Office of the Chief of Engineers
O&M	Operation and Maintenance
OMA	Operation and Maintenance, Army
OMAR	Operation and Maintenance, Army Reserve
PAX	Programming, Administration, and Execution System
PC	personal computer
TRADOC	Training and Doctrine Command
UFR	Unfinanced Requirements Report
USACE	U.S. Army Corps of Engineers
USA-CERL	U.S. Army Construction Engineering Research Laboratory

USA-CERL DISTRIBUTION

Chief of Engineers
  ATTN: Tech Monitor

USAFEA
8th USA, Korea

HQ AMC
  ATTN: DCSENG
  Alexandria, VA 22314

HQ FORSCOM
Fort McPherson, GA 30330

WESTCOM
Fort Shafter, HI 96858

HQ TRADOC
Fort Monroe, VA 23516

HQ Health Services Command
Fort Sam Houston, TX 78234

HQ Military Traffic Command
Washington, D.C. 20315

HQ USAREUR
APO NY 09403

Information Systems Command
Fort Huachucca, AZ 85613

Defense Technical Info. Center 22314
  ATTN: DDA (2)

U.S. Govt Printing Office 22304
  Receiving Sect/Depository Copies (2)

END
DATE
FILMED
5-88
DTIC